

## **APPENDIX 2 – OFF-ROAD EQUIPMENT**

Below is additional information pertaining to the Off-Road Equipment Category for the South Coast Air Quality Management District's (AQMD's) FY 2003 Carl Moyer Program (Moyer Program). All information in RFP #P2004-04 and this Appendix apply. For additional detail regarding this program category, refer to the California Air Resources Board's (CARB's) 2003 Moyer Program Guidelines<sup>1</sup>. In the case of any conflict between CARB guidelines and AQMD criteria, the more stringent criteria will prevail.

### **INTRODUCTION**

Off-road engines are used in a wide variety of applications, including, but not limited to, the following: agricultural tractors, backhoes, excavators, trenchers, motor graders, portable generators, excavators, compressors, and miscellaneous applications. Off-road equipment eligible for funding under the Carl Moyer Program includes equipment 50 horsepower or greater. Excluded from this program type are engines that propel or are used on aircraft, locomotives and marine vessels. This program does not apply to off-road engines used for underground mining operations and that are regulated by the Mining Safety and Health Administration. Marine vessels are covered in Appendix 4 and Forklifts are covered in Appendix 6. Locomotives are covered in Appendix 3. Please refer to RFP #P2004-04 for additional requirements beyond those detailed below.

### **PROGRAM GUIDELINES**

#### **Changes for 2003**

Below are important changes to the Moyer Program On-Road Vehicle category for 2003:

- Some equipment is now certified to a NO<sub>x</sub> +NMHC emission standard. Since the Moyer program only considers NO<sub>x</sub> emissions in emissions calculations, the factors in Table 2.3 should be applied.
- CARB developed a California diesel fuel correction factor (CA-FCF), which needs to be applied to baseline diesel emission rates to more accurately reflect the emissions from diesel engines when those engines are operated using California diesel fuel.
- The overall cost-effectiveness threshold for the Moyer Program was increased to \$13,600 per ton of NO<sub>x</sub> reduced and the capital recovery factor was reduced to 3 percent. Note that construction equipment projects must not exceed a cost-effectiveness limit of \$6,000 per ton of NO<sub>x</sub> reduced. All other off-road projects

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<sup>1</sup> Be sure to visit <http://www.arb.ca.gov/msprog/moyer/moyer.htm> for the latest approved CARB Moyer Program Guidelines.

funded in the off-road category must meet a cost-effectiveness criterion of \$13,600 per ton of NOx reduced.

- The NOx emission factors have been updated to reflect the recently adopted OFFROAD emissions model.

## Project Eligibility Criteria

Reduced-NOx off-road equipment projects that include new equipment purchases, equipment repowers or engine retrofits will be considered and evaluated for incentive funding. In general, off-road equipment projects must meet the following criteria:

- For a new equipment purchase, the new engine must be certified to a CARB optional NOx or NOx+NMHC emission credit standard for off-road diesel equipment that is at least 30 percent lower than the current applicable emission standard. New engines that are certified to FEL levels are not eligible for funding in new equipment purchase projects.
- For equipment repower projects that replace uncontrolled engines in existing equipment, a new replacement engine must be certified to the current emission standard, to an FEL NOx or NOx+NMHC level that is lower than the required emission standard, or to an optional credit emission standard as applicable for the horsepower rating.
- In the event that the use of a new replacement engine meeting the current applicable standard is not technically feasible, the replacement unit must be a new replacement engine or an emission-certified rebuilt or remanufactured engine meeting the previously applicable emission standard. In most cases the previously applicable standard is Tier 1. The determination of eligibility of a newer engine for repower shall be made on case-by-case basis by CARB and AQMD staff.
- For equipment repower projects that replace emission-certified engines in existing equipment, the new or newer replacement engine must be certified to a NOx emission standard that is at least 15 percent lower than the emission standards applicable to the existing engine.
- Newer replacement engines used in equipment repower projects could be either new, rebuilt, or remanufactured units, offered by the OEM or by a non-OEM rebuilder that demonstrates to the CARB that the rebuilt engine and parts are functionally equivalent from an emissions and durability standpoint to the OEM engine and components being replaced.
- If the replacement engine is rated at a higher horsepower than the existing engine, the load factor for the replacement engine must be corrected for the power rating difference,  $Load\ Factor_{replacement} = Load\ Factor_{existing} * hp_{existing}/hp_{replacement}$

This criterion would also apply to other project categories using off-road engines (i.e., agricultural pumps, forklifts, etc.)

- For engine retrofit projects: (i) the retrofit kit must be verified to reduce NOx emissions to 6.9 g/bhp-hr, or lower, when used to retrofit an eligible uncontrolled engine, or (ii) the retrofit kit must be verified to reduce NOx emissions by at least 15 percent when used to retrofit eligible emission-certified engines.
- Reduced-emission engines or retrofit kits must be verified for sale in California and must comply with durability and warranty requirements. Qualified engines could include new CARB-certified engines or CARB-certified aftermarket part engine/control devices.
- Engines designated for participation in any averaging, banking, and trading (AB&T) program that are certified to FEL levels higher than the applicable emissions standards are not eligible to participate in the Carl Moyer Program.
- Engines designated for participation in any averaging, banking, and trading (AB&T) program (i.e., all FEL-certified engines) are not eligible for new equipment purchase projects.
- Engines manufactured under the flexibility provisions for off-road compression-ignition (diesel) engines that do not meet the current required standards are not eligible to participate in the Carl Moyer Program.
- NOx reductions obtained through this program must not be required by any existing regulations, memoranda of understanding/agreement, or other legally binding documents.
- Funded projects must operate for a minimum of 5 years and at least 75 percent of total equipment hours of operation must occur in South Coast Air Basin.
- Construction equipment projects must not exceed a cost-effectiveness criterion of up to \$6,000 per ton of NOx reduced. All other off-road projects funded in this category must meet a cost-effectiveness criterion of \$13,600 per ton of NOx reduced.
- Off-road projects that fall outside of these criteria may be considered on a case-by-case basis if evidence provided to AQMD suggests potential, surplus, real, quantifiable and enforceable emission reduction benefits.

## Evaluation Methodology

AQMD staff will evaluate all submitted proposals and make recommendations to the Governing Board for final selection of project(s) to be funded. Proposals will be evaluated based on the cost-effectiveness of NOx reduced on an equipment-by-equipment basis, as well as a project's "disproportionate impact" evaluation (discussed below). Be aware of the possibility that due to program priorities and/or funding limitations, project applicants may be offered only partial funding, and not all proposals that meet minimum cost-effectiveness criteria may be funded.

In compliance with AB 1390, Firebaugh, the FY 2003 Moyer Program requires that at least 50 percent of the funds be spent in areas that are disproportionately impacted by air pollution. CARB has issued broad goals and left the details of how to implement this requirement to each air agency. In the South Coast Air Quality Management District, the disproportionately impacted areas are defined by a weighted formula that includes poverty level, particulate matter (PM) exposure and toxic exposure. The process is described below:

1. All projects must qualify for the Moyer Program by meeting the cost-effectiveness limits established in the RFP.
2. All projects will be evaluated according to the following criteria to qualify for Disproportionate Impact funding:
  - a. Poverty Level: All projects in areas where at least 10 percent of the population falls below the Federal poverty level based on the year 2000 census data, will be eligible to be included in this category, and
  - b. PM Exposure: All projects in areas with the highest 15 percent of PM concentration will be eligible to be ranked in this category. The highest 15 percent of PM concentration is 46 micrograms per cubic meter and above, on an annual average, or
  - c. Toxic Exposure: All projects listed in the Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES II) report<sup>2</sup> as having a cancer risk of 1,000 in a million and above will be eligible to be ranked in this category.

Data for the poverty level and PM and toxic exposures were obtained from the U.S. Census, the 1998 AQMD monitoring data and Mates II study respectively.

3. Fifty percent of the \$12.3 million available for this RFP will be allocated among proposals located in disproportionately impacted areas. If the funding for disproportionately impacted areas is not exhausted with the outlined methodology, then staff will return to the Governing Board for direction. If

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<sup>2</sup> Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES II), SCAQMD, March 2000.

funding requests exceed 50 percent of the total available funding, then all qualified projects will be ranked based on their disproportionate impact. Each project will be assigned a score that is comprised of 40 percent for poverty level, and 30 percent each for PM and toxic exposures. Proposals with the highest scores will receive funding until 50 percent of the total funding is allocated.

All the proposals not awarded under the fifty percent disproportionate impact funding analysis will then be ranked according to cost-effectiveness, with the most cost-effective project funded first and then in descending order for each funding category until the remainder of the Moyer Funds are exhausted. Some projects that exceed the cost-effectiveness ceiling may receive partial funding, depending on their rankings.

## **Eligible Costs**

Eligible project costs (i.e., costs for which Moyer funding is requested) are limited to the incremental cost of a project to implement the reduced emission technology and the cost of an hour-meter. Operation and maintenance costs are not eligible for Moyer Program funding. Please refer to the Project Types section below for additional detail.

## **Reporting and Monitoring**

All participants in the Moyer Program are required to keep appropriate records during the full life of the project (minimum of 5 years). Records must be retained and updated throughout the project life and made available for AQMD inspection. The AQMD may conduct periodic reviews of each project's operating records to ensure that the engine is operated as stated in the program application. Annual records must contain, at a minimum:

- Total hours operated
- Total hours operated in the South Coast Air Basin
- Annual fuel consumed
- Maintenance and repair information

## **PROJECT TYPES**

The eligibility requirements for off-road engine projects are illustrated in the summary provided in Table 2.1. The revised project criteria included in this chapter are designed to ensure that emission reductions achieved by the deployment of reduced-emission engines or retrofit technologies continue to be surplus, real, quantifiable, and enforceable.

**Table 2.1 – Off-Road Engine Project Eligibility Summary.**

New Equipment Purchase	Engine in new equipment must be certified to optional emission standard that is at least 30 percent lower than current standard for engine	
Equipment Repower		
Existing Engine	New Replacement Engine	OEM Rebuilt/Remanufactured Replacement Engine
<u>Uncontrolled</u>	1. Must be certified to current emission standard 2. On a case-by-case basis, and with approval, may consider new replacement engine certified to a previously applicable emission standard if use of an engine meeting the current emission standard is not technically feasible 2. Must achieve at least 15 percent NOx emission reductions from baseline emissions of existing engine	1. Must be emission-certified 2. Must achieve at least 15 percent NOx emission reductions from baseline emissions of existing engine
<u>Emission-Certified</u>	1. Must be certified to current emission standard 2. Must achieve at least 15 percent NOx emission reduction from baseline emission of existing engine	1. Must be emission-certified 2. Must achieve at least 15 percent NOx emission reductions from baseline emissions of existing engine
Engine Retrofit		
Existing Engine	New Retrofit Kit	
<u>Uncontrolled</u>	Retrofit kit has to be verified to reduce emissions to at least Tier 1 (6.9 g/bhp-hr)	
<u>Emission-Certified</u>	Retrofit kit has to be verified to reduce emissions by at least 15 percent relative to baseline emissions of existing engine	

## **Purchase of New Equipment Powered by New Emission-Certified Engines**

A project in this category is required to provide 30 percent reduction beyond the technology that is available for purchase under current regulations. For most off-road engine categories, the current standard is Tier 2 with an optional standard starting at 4.0 g/bhp-hr NO<sub>x</sub>+NMHC and decreasing in 0.5 g/bhp-hr increments. Since there are no off-road engines certified to an optional NO<sub>x</sub> emission credit standard available at this time, AQMD does not expect to receive such project applications.

Additionally, new equipment having an engine that was certified to an FEL level would not be eligible for the Moyer program. This is because the emission level from an eligible FEL engine in the new equipment would be considered to be at the level of the required emission standard for that engine, as discussed previously. Therefore, the emissions from an FEL engine in the new equipment would not be surplus when compared to the emissions from a new engine meeting the required emission standards.

## **Repower with Emission-Certified Engines**

Purchases of new emission-certified engines to replace uncontrolled engines in existing equipment are the most common type of off-road diesel repower projects. In the event that repowering with a new engine meeting current applicable emission standards (Tier 2) is not technically feasible as determined by CARB and district staff, a newer emission-certified engine that meets the previously applicable standards (Tier 1) may be used upon CARB approval.

Eligible off-road equipment repower projects also include the replacement of an emission-certified engine with a newer and similarly certified engine that meets an optional NO<sub>x</sub> emission credit standard. Furthermore, another possible option may be to repower off-road diesel equipment with a new or rebuilt on-road engine certified to a NO<sub>x</sub> emission standard of at least 6.0 g/bhp-hr. CARB, on a case-by-case basis, may grant an experimental permit for operation of the off-road equipment with the on-road engine. Consideration for funding under the Moyer Program would be given on a case-by-case basis. Moyer Program funding is not available for projects where a spark-ignition engine (i.e., natural gas, gasoline, etc.) is replaced with a diesel engine.

## **Retrofits**

Retrofit refers to modifications made to an engine and/or fuel system such that the specifications of the retrofitted engine are not the same as the original engine. Retrofit projects may be applicable to an entire diesel engine family. The most straightforward retrofit projects are upgrades of components that can be accomplished at the time of engine rebuild and result in a lower emission configuration. It is possible that retrofit technologies that have been used to reduce NO<sub>x</sub> and PM emissions from on-road heavy-duty diesel engines could be used to control off-road engine emissions in some

applications. To qualify for Moyer Program funding, the retrofit kit for an uncontrolled engine must be certified to reduce NOx emissions to 6.9 g/bhp-hr or lower. The Moyer Program may also be used to fund retrofit kits for emission-certified engines that result in NOx emission reductions of at least 15 percent.

## **Emerging Technologies**

Several reduced-emission technologies hold promise for the future, but are not yet commercially available. These technologies, as discussed in the previous chapter, are being developed for both on-road and off-road heavy-duty diesel engines. Some of these technologies may include NOx catalyst and selective catalytic reduction. These technologies may be developed as engine retrofit or new engine technologies and become eligible for program participation after CARB grants verification for sale in California. In addition, the criteria for evaluation of other promising emerging technologies for off-road engine applications is the same as the criteria discussed for on-road engines. In the event that a unique technology with demonstrated potential for emission reductions has been evaluated by CARB, an experimental permit may allow the engine technology to operate in California. In these cases, AQMD may grant approval for participation in its Moyer Program. Note however, that these applications are considered on a case-by-case basis and are typically granted with strict limitations for demonstrations only.

## **EMISSION REDUCTION AND COST-EFFECTIVENESS**

### **Emission Reduction Calculation Discussion**

Emission reduction benefits represent the difference in the emission levels of the existing baseline engine relative to the newer, reduced-emission, replacement engine. Table 2.2 shows the NOx and NOx + NMHC Off-Road Compression Ignition Engine Standards in effect now and being implemented in the future. Some emission standards for heavy-duty diesel engines are a combined NOx+NMHC standard. To determine the NOx fraction from the combined NOx+NMHC values, the certification NOx+NMHC emission standard for an engine is multiplied by the appropriate NOx fraction. Table 2.3 provides the default NOx fraction factors, to be multiplied by the NOx+NMHC emission factors to get NOx-only emission rates.



**Table 2.2 Off-Road Compression-Ignition Engine Standards**  
**NMHC+NOx/CO/PM in g/hp-hr (g/kW-hr)**  
**Standards Include an Emissions Durability Period<sup>(c,d,e)</sup>**

hp (kw)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
<11 (8) <sup>(c)</sup>					7.8 (10.5) 6.0 (8.0) 0.75 (1.0)					5.6 (7.5) 6.0 (8.0) 0.60 (0.80)	
11 (8) <25 (19) <sup>(c)</sup>					7.1 (9.5) 4.9 (6.6) 0.60 (0.80)					5.6 (7.5) 4.9 (6.6) 0.60 (0.80)	
25 (19) <50 (37) (c,d)				7.1 (9.5) 4.9 (6.6) 0.60 (0.80)					5.6 (7.5) 4.1 (5.5) 0.45 (0.60)		
50 (37) <100 (75) <sup>(e)</sup>			N/A <sup>(a)</sup> 6.9 (9.2) N/A N/A						5.6 (7.5) 3.7 (5.0) 0.30 (0.40)		
100 (75) <175 (130) (e)		N/A <sup>(a)</sup> 6.9 (9.2) N/A N/A						4.9 (6.6) 3.7 (5.0) 0.22 (0.30)			
175 (130) <300 (225) (e)	1.0 (1.3) <sup>(a)</sup> 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)							4.9 (6.6) 2.6 (3.5) 0.15 (0.20)			3.0 (4.0) 2.6 (3.5) (b)
300 (225) <600 (450) (e)	1.0 (1.3) <sup>(a)</sup> 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)					4.8 (6.4) 2.6 (3.5) 0.15 (0.20)				3.0 (4.0) 2.6 (3.5) (b)	
600 (450) <750 (560) (e)	1.0 (1.3) <sup>(a)</sup> 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)						4.8 (6.4) 2.6 (3.5) 0.15 (0.20)			3.0 (4.0) 2.6 (3.5) (b)	
>750 (560) (e)					1.0 (1.3) <sup>(a)</sup> 6.9 (9.2) 8.5 (11.4) 0.40 (0.54)						4.8 (6.4) 2.6 (3.5) 0.15 (0.20)

(a) Standards given are HC/NOx/CO/PM in g/hp-hr (g/kW-hr).

(b) PM standards have not been specified.

(c) For all engines rated under 25 hp (19 kW), and for constant speed engines rated under 50 hp (37 kW) with rated speeds greater than or equal to 3,000 rpm, the durability period and useful life is a period of 3,000 hours or five years of use, whichever first occurs.

(d) For all other engines rated at or above 25 hp (19 kW) and under 50 hp (37 kW), the durability period and useful life is a period of 5,000 hours or seven years of use, whichever first occurs.

(e) For all engines rated at or above 50 hp (37 kW), the durability period and useful life is a period of 8,000 hours of operation or ten years of use, whichever first occurs.

**Table 2.3 – NOx Fraction Default Values**

Diesel Engines	Alternative Fuel Engines
0.95	0.80

Baseline emission factors are listed in Table 2.4. These reflect the recently adopted OFFROAD emission inventory model for off-road large compression ignition (CI) engines greater than or equal to 25 hp. For Moyer Program applicants wishing to use an alternative to the baseline emission factors illustrated in Table 2.4, dynamometer testing of an uncontrolled engine using CARB-approved test procedures may be utilized to determine actual emission factors.

Off-road engine manufacturers are legally allowed the flexibility to participate in an AB&T program in lieu of only producing engines that are compliant with the current emission standards. The emission benefits from an engine certified to a lower Family Emission Limit (FEL) are necessary to offset the emissions from engines certified to a higher FEL levels within the engine manufacturer's AB&T program. Since engine manufacturers can generate AB&T emission credits for the increment of emissions from the lower FEL level to the required emission standards, that portion of emissions cannot be used for the purpose of calculating Moyer emission benefits. Engines that were certified to FEL levels higher than the applicable required emission standards are not eligible for participation in the Moyer program, nor are new equipment purchase projects if the engine is an FEL engine.

FEL engines can only be funded for equipment repower projects only if they are certified to a level that is below the required emission standard. The amount of emission reduction that can be claimed for Moyer calculations is the difference between the applicable required emission standard for the replacement engine (not the FEL level) and the baseline emission levels of the existing engines. This eliminates double counting emission benefits and ensures that real emission benefits are achieved under the Moyer program. In addition, current regulations for off-road heavy-duty CI engines contain flexibility provisions that allow engine manufacturers to produce a certain number of non-compliant engines. Thus, flexibility engines are not certified to current emission standards.



**Table 2.4 – Baseline NOx and PM Emission Factors for  
Uncontrolled Off-Road HD Diesel Engines (g/bhp-hr)**

<b>Horsepower</b>	<b>Engine Model Year</b>	<b>NOX (g/bhp-hr)</b>	<b>PM (g/bhp-hr)</b>
50-120	Pre-1988	13	0.84
50-120	1988-1997	8.75	0.69
121-175	Pre-1970	14	0.77
	1970-1971	13	0.66
	1972-1979	12	0.55
	1980-1987	11	0.55
	1988-1996	8.17	0.38
176-250	Pre-1970	14	0.77
	1970-1971	13	0.66
	1972-1979	12	0.55
	1980-1987	11	0.55
	1988-1995	8.17	0.38
251-750	Pre-1970	14	0.74
	1970-1971	13	0.63
	1972-1979	12	0.53
	1980-1987	11	0.53
	1988-1995	8.17	0.38
>750	Pre-1970	14	0.74
	1970-1971	13	0.63
	1972-1979	12	0.53
	1980-1987	11	0.53
	1988-1999	8.17	0.38

The maximum allowable baseline emissions for pre-1996 engines as determined through in-use testing is 13 g/bhp-hr (<120 hp) and 14 g/bhp-hr (>120 hp).

In situations where the model year of the equipment and the model year of the existing engine are different, the newer of the two model years, of either the equipment or the engine, shall be used to determine the baseline emissions for benefit calculations. For off-road equipment (i.e., yard hostlers, yard goats) capable of operation with a new certified on-road engine meeting an optional NOx emission credit standard instead of a new off-road engine, emission benefits from the baseline engine will be based on an on-road engine. If an applicant provides sufficient documentation to show that past practices involve predominantly the use of off-road engines in yard hostlers, then an off-road engine emission factor baseline can be used.

Emission levels are calculated by multiplying the engine emission factor by a conversion factor and an activity level, or

$$\text{Annual NOx emissions} = \text{NOx[g/bhp-hr]} * \text{Activity} * \text{Conversion Factor}$$

For off-road equipment, the activity level is either the annual hours of operation or annual fuel consumed. Records are required to be maintained over the life of the project in order to determine actual emission reductions achieved by the program.

#### Hour-Based Calculation

When actual annual hours of equipment operation are the basis for determination of emission reductions, the appropriate conversion factor is the horsepower rating of the engine and an engine load factor:

*Annual NOx emissions =*

$$NOx[g/bhp-hr] * Activity[hrs/yr] * Engine Rating[hp] * Load Factor$$

Annual hours of equipment operation for determining emission reductions must be based only on readings from a properly installed and fully operational hour-meter. An hour-meter should be included in the application for Moyer funding, if not already installed on the equipment.

The engine load factor is an indicator of the nominal amount of work done by the engine for a particular application. It is given as a fraction of the rated horsepower of the engine and varies with engine application. When an actual load factor is known for a specific application, the applicant may justify its use for calculating emission reductions to CARB and AQMD by submitting appropriate and sufficient documentation. If a specific load factor is not known, the default load factors for off-road equipment in agricultural and construction applications listed in Table 2.5 must be used. The adopted OFFROAD emission inventory model reflects load factors ranging from 0.43 to 0.78 for heavy-duty diesel engines in agricultural and construction applications. For applications or equipment not listed in Table 2.5, a default load factor of 0.43 must be used, as summarized in Table 2.6.

**Table 2.5 – Default Load Factors for Off-Road Heavy-Duty Diesel Engines  
In Agricultural and Construction Applications**

Category	Equipment Type	Load Factor
Agriculture	Agricultural Mowers	0.43
	Agricultural Tractors	0.70
	Balers	0.58
	Combines	0.70
	Hydro Power Units	0.48
	Sprayers	0.50
	Swathers	0.55
	Tillers	0.78
	Irrigation Pumps	0.65
	Other Agricultural Equipment	0.51
Construction	Cranes	0.43
	Crawler Tractors	0.64
	Crushing/Processing	0.78
	Excavators	0.57
	Graders	0.61
	Off-Highway Tractors	0.65
	Off-Highway Trucks	0.57
	Pavers	0.62
	Other Paving Equipment	0.53
	Rollers	0.56
	Rubber-Tired Dozers	0.59
	Rubber-Tired Loaders	0.54
	Scrapers	0.72
	Signal Boards	0.78
	Skid Steer Loaders	0.55
	Surfacing Equipment	0.45
	Tractors/Loaders/Backhoes	0.55
	Trenchers	0.75
	Other Construction Equipment	0.62

**TABLE 2.6 – Off-Road Diesel Engine Default Load Factor**

	<b>Default</b>
Load Factor	0.43

The use of California's diesel fuel since 1993 (0.05 percent sulfur content by weight and 10 percent aromatic content by volume) would result in fewer NOx and PM emissions from diesel engines compared to the base emission rates. Base emission rates for diesel engines, as embodied in OFFROAD and presented in Table 2.4 for uncontrolled engines, were derived from test data using either federal diesel fuel (0.05 percent sulfur

content by weight) or pre-1993 diesel fuel. Federal diesel fuel is also used for new engine certification to comply with the emission standards shown in Table 2.2.

Thus, a fuel correction factor needs to be applied to the base emission rate, for both uncontrolled and emission-certified engines, to more accurately reflect the emissions from diesel engines when those engines are operated using California diesel fuel.

**Table 2.7 Fuel Correction Factors (Off-Road Diesel Engines)**

Model Year	NOx	PM
Pre – Tier I	0.94	0.80
Tier I +	0.87	0.90

### Fuel-Based Calculations

When annual fuel consumption is used for determining emission reductions, the equipment activity level must be based, preferably, on actual annual fuel receipts, or other similarly appropriate documentation provided by the applicant. In this approach, an energy consumption factor must be determined to allow conversion of emissions given in g/bhp-hr to units of grams of emissions per gallon of fuel used (g/gal). The energy consumption factor may be determined by: 1) dividing the horsepower rating of the engine by its fuel economy expressed in units of gallons per hour (gal/hr), or 2) dividing the energy density of the fuel (in units of BTU/gal) by the brake-specific fuel consumption of the engine. While actual fuel receipts support the annual fuel consumption of the existing baseline engine, the annual fuel consumption of the replacement, reduced-emission engine may be estimated in proportion to the change in ECF whether the engine is diesel or alternative fuel

$$(3,696 \text{ gal/yr}) * (18.5 \text{ hp-hr/gal}) / (20 \text{ hp-hr/gal}) = 3,419 \text{ gal/yr}$$

Future fuel receipts or equivalent documentation must be submitted to the local district throughout the project life for verification. The default energy consumption factor for diesel engines is provided below in Table 2.8.

**TABLE 2.8 –Off-Road Diesel Engine Default Energy Consumption Factor**

	Default
Energy Consumption Factor	18.5 bhp-hr/gal

### **Cost-Effectiveness Calculation Discussion**

The only portion of the project cost that is eligible for Moyer Program funding is the difference between the total installed cost of the replacement emission-certified engine and the total cost of either rebuilding the existing engine or purchasing a conventional

replacement engine. Only the funding provided by the Moyer Program are to be used in the cost-effectiveness calculations. The one-time incentive grant must be amortized over the expected project life (at least five years) assuming a discount rate of 3 percent. The amortization formula given below yields a capital recovery factor (CRF), which, when multiplied by the initial capital cost, gives the annual cost of a project over its expected lifetime.

$$\text{Capital Recovery Factor (CRF)} = [(1 + i)^n (i)] / [(1 + i)^n - 1]$$

where,

$i$  = discount rate (3 percent)  
 $n$  = project life (at least five years)

Table 2.9 lists the CRFs for different project lives based on a discount rate of 3 percent. Project cost-effectiveness is determined by dividing the total annualized cost by the total annual NOx emission reductions. Sample calculations for off-road equipment projects are provided below.

**Table 2.9 – Capital Recovery Factors (CRF) for Various Project Lives  
At 3 percent Discount Rate**

Project Life	CRF
5	0.218
6	0.185
7	0.161
8	0.142
9	0.128
10	0.117
11	0.108
12	0.100
13	0.094
14	0.089
15	0.084
16	0.080
17	0.076
18	0.073
19	0.070
20	0.067

## Project Life

As discussed above, a key parameter in the determination of a project's emission reduction benefit is its project life. The acceptable maximum life for calculating the project benefits of off-road equipment projects is summarized below in Table 2.10.



**Table 2.10 – Maximum Project Life for Off-Road Equipment Projects**

	<u>Default without Documentation</u>	<u>Default with Documentation</u>
Off-road New	10 years	15 years
Off-road Repower	7 years	15 years

Project life beyond the “default without documentation” limits may be submitted for approval by CARB.

### **Example 1 – Construction Equipment Repower (Based on Hours of Operation)**

An equipment owner applies for a Moyer Program grant for the purchase of a new 2003 model year Tier 2 off-road diesel engine rated at 180 hp to replace a 1985 uncontrolled diesel engine rated at 150 hp used in a construction loader. The owner does not know the load factor for this application. Both the old and new engine will operate 700 hours annually and 100 percent of the time in the South Coast Air Basin. The cost of the new emission-certified diesel engine is \$16,000, whereas the cost to rebuild the existing engine is \$8,000. Installation and re-engineering cost (to install the new engine into the existing equipment) is \$6,000.

#### Emission Reduction Calculation

**Existing Engine NOx Emission Factor (Table 2.4):** 11 g/bhp-hr

**Adjusted Existing Engine NOx Emission Factor (using fuel correction factor in Table 2.7):**

$$(11 \text{ g/bhp-hr})(0.94) = 10.34 \text{ g/bhp-hr}$$

**Proposed Replacement Engine NOx+NMHC Emission Factor (Table 2.2):** 4.9 g/bhp-hr

**Adjusted Replacement Engine NOx Emission Factor (using default NOx fraction in Table 2.3 and fuel correction factor in Table 2.7):**  $(4.9 \text{ g/bhp-hr})(0.95)(0.87) = 4.05 \text{ g/bhp-hr NOx}$

**Existing (Baseline) Engine Horsepower:** 150 hp

**Replacement Engine Horsepower:** 180 hp

**Baseline Load Factor (Table 2.5):** 0.55

**Replacement Engine Load Factor:**  $0.55(150\text{hp}/180\text{hp}) = 0.46$

**Annual Hours of Operation:** 700 hours

**Percent Operated in CA:** 100 percent

Hence, the estimated reductions are:

#### Baseline Engine:

$$(10.34\text{g/bhp-hr} * 0.55 * 150 \text{ hp}) * 700 \text{ hrs/yr} * 100 \text{ percent} * \text{ton}/907,200 \text{ g} = 0.66 \text{ t/yr}$$

#### Reduced-Emission Engine:

$$(4.05 \text{ g/bhp-hr} * 0.46 * 180 \text{ hp}) * 700 \text{ hrs/yr} * 100 \text{ percent} * \text{ton}/907,200 \text{ g} = 0.26 \text{ t/yr}$$

**NOx Emission Reductions:  $0.66-0.26=0.40$  tons/year NOx emissions reduced**

## Cost and Cost-Effectiveness Calculations

The annualized cost is based on the incremental project cost of the repower project, the expected life of the project (7 years default life), and the capital recovery factor used to amortize the project cost over the project life. The incremental capital cost to the equipment owner for this purchase and the maximum amount of Moyer Program funding are determined as follows:

<b>Total installed cost of new engine:</b>	$\$ 16,000 + \$ 6,000 = \$ 22,000$
<b>Incremental Capital Cost:</b>	$\$ 22,000 - \$ 8,000 = \$ 14,000$
<b>Max. Amount Funded:</b>	$\$ 14,000$
<b>Capital Recovery (Table 2.9):</b>	$= 0.161$
<b>Annualized cost:</b>	$(0.161)(\$ 14,000) = \$ 2,254/\text{year}$
<b>Cost-Effectiveness:</b>	$(\$ 2,254/\text{year})/(0.40 \text{ tons/year}) = \$5,635/\text{ton}$

The project meets the cost-effectiveness limit of \$6,000 per ton NOx reduced. This project would qualify for the maximum amount of grant funds requested.

### **Example 2 – Agricultural Harvester Repower (Based on Fuel Consumption)**

An equipment owner applies for Moyer Program funding for the purchase of an OEM off-road diesel engine certified for use as a replacement engine to Tier 1 emission standards (170 hp, 6.9 g/bhp-hr NOx). That engine will be used to replace an uncontrolled diesel engine (1980, 200 hp, 11 g/bhp-hr NOx, 17.0 bhp-hr/gal energy consumption factor) used in a harvester. The installed cost of the replacement emission-certified diesel engine is \$9,500, whereas, the cost to rebuild and install the existing engine is approximately \$6,900. The existing engine consumes 4,600 gallons of diesel fuel annually. The replacement engine will operate 100 percent of the time in the South Coast Air Basin for five years.

## Emission Reduction Calculation

<b>Existing (Baseline) Engine NOx Emissions:</b>	11.0 g/bhp-hr
<b>Adjusted Existing Engine NOx Emission Factor (using fuel correction factor in Table 2.7):</b>	$(11 \text{ g/bhp-hr})(0.94) = 10.34 \text{ g/bhp-hr}$
<b>Baseline Energy Consumption Factor:</b>	17.0 hp-hr/gal (given)
<b>Baseline Annual Fuel Consumed:</b>	4,600 gallons
<b>Replacement Engine NOx Emissions:</b>	6.9 g/bhp-hr
<b>Adjusted Replacement Engine NOx Emission Factor (using fuel correction factor in Table 2.7):</b>	$(6.9 \text{ g/bhp-hr})(0.87) = 6.0 \text{ g/bhp-hr NOx}$
<b>Replacement Engine Energy Content Factor:</b>	18.5 hp-hr/gal (default value – Table 2.8)
<b>Replacement Engine Annual Fuel Consumed ((4,600)(17/18.5)):</b>	4,227 gallons
<b>Percent Operated in CA:</b>	100 percent
<b>(ton/907,200 g):</b>	Converts grams to tons

Hence, estimated annual NOx reductions are:

### Baseline Engine:

$$(10.34 \text{ g/bhp-hr} * 17.0 \text{ bhp-hr/gal} * 4,600 \text{ gal/yr}) * 1.0 * \text{ton}/907,200 \text{ g} = 0.89 \text{ tons/year}$$

#### Replacement Engine:

$(6.0 \text{ g/bhp-hr} * 18.5 \text{ hp-hr/gal} * 4,227 \text{ gal/yr}) * 1.0 * \text{ton}/907,200 \text{ g} = 0.52 \text{ tons/year}$

**NOx Emission Reductions:  $0.89 - 0.52 = 0.37$  tons/year NOx emissions reduced**

#### Cost and Cost-Effectiveness Calculations

The annualized cost is based on the incremental project costs funded by the Moyer Program, the expected life of the project (5 years at a minimum), and the capital recovery factor used to amortize the project cost over the project life. Incremental capital costs to the fleet operator and the maximum eligible Moyer Program funding are determined as follows:

<b>Incremental Capital Cost:</b>	$\$ 9,500 - \$ 6,900 = \$ 2,600$
<b>Max. Amount funded from Carl Moyer Program:</b>	$\$ 2,600$
<b>Capital Recovery Factor (Table 2.9):</b>	$= 0.218$
<b>Annualized cost:</b>	$(0.218)(\$ 2,600) = \$ 567/\text{year}$
<b>Cost-Effectiveness:</b>	$(\$ 567/\text{year})/(0.37 \text{ tons/year}) = \mathbf{\$ 1,532/\text{ton}}$

The project meets the cost-effectiveness limit of \$13,600 per ton NOx reduced. This project would qualify for the maximum amount of grant funds requested.

#### **Example 3 – Construction Equipment Repower with an Engine Certified to an FEL Level (Calculations Based on Hours of Operation)**

An equipment owner applies for a CMP grant for the purchase of a new 2003 model year off-road diesel engine rated at 300 hp to replace a 1997 diesel engine rated at 300 hp used in a construction scraper. The new 2003 engine was certified to an FEL level of 4.2 g/bhp-hr NOx+NMHC (the applicable emission standard for that engine is 4.8 g/bhp-hr NOx+NMHC (Tier 2)). The existing engine, 1997-model year, was certified to the Tier 1 NOx emission standard of 6.9 g/bhp-hr. Both the old and new engine will operate 1000 hours annually and 100% of the time in California.

#### Emission Reduction Calculation

<b>Existing Engine NOx Emission Factor (Table 2.4):</b>	6.9 g/bhp-hr
<b>Adjusted Existing Engine NOx Emission Factor</b> (using fuel correction factor in Table 2.7):	$(6.9 \text{ g/bhp-hr})(0.87) = 6.00 \text{ g/bhp-hr}$
<b>Replacement Engine FEL NOx+NMHC Emission Level:</b>	4.2 g/bhp-hr
<b>Required NOx+NMHC Emission Level</b> (Tier 2 emission standard):	4.8 g/bhp-hr
<b>Adjusted Replacement Engine NOx Emission Factor</b> (using required NOx+NMHC emission standard, default NOx fraction in Table 2.4, and fuel correction factor in Table 2.7):	$(4.8 \text{ g/bhp-hr})(0.95)(0.87) = 3.97 \text{ g/bhp-hr NOx}$
<b>Load Factor (Table 2.6):</b>	0.72
<b>Annual Hours of Operation:</b>	1000 hours
<b>% Operated in CA:</b>	100%

The estimated reductions are:

Baseline Engine:

$$(6.00\text{g/bhp-hr} * 0.72 * 300 \text{ hp}) * 1000 \text{ hrs/yr} * 100\% * \text{ton}/907,200 \text{ g} = 1.43 \text{ t/yr}$$

Reduced-Emission Engine:

$$(3.97 \text{ g/bhp-hr} * 0.72 * 300 \text{ hp}) * 1000 \text{ hrs/yr} * 100\% * \text{ton}/907,200 \text{ g} = 0.94 \text{ t/yr}$$

**NOx Emission Reductions:  $1.43 - 0.94 = 0.49$  tons/year NOx emissions reduced**

Note that this example does not address cost and cost-effectiveness calculations.

<b>Carl Moyer Memorial Air Standards Attainment Program</b> <b>OFF-ROAD HEAVY-DUTY VEHICLE PROJECT</b> <b>APPLICATION</b>
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Please provide all information requested regarding your proposed purchase and application. Additional information may be requested during the review process. Applicant acknowledges that award of cash incentive is subject to AQMD approval and must meet the minimum eligibility criteria within the project category. **Please Print or Type**

**A. APPLICANT INFORMATION**

Organization:		
Contact name:		
Person with contract signing authority:		
Street/mailling address:		
City:	State:	Zip code:
Project Location Address:		
City:	State:	Zip code:
Phone: (     )	Fax: (     )	
E-mail:		
Geographic area served by organization (i.e., project location):		
Geographic area to be served by vehicle (if different than above):		
Number of heavy-duty vehicles/Equipment in fleet:		

**Please fill out the table below for all vehicles for which funding is requested.**

Vehicle/Equipment Type	Number of Vehicles/Equipment	Funding Request per Vehicle/Equipment	Total Funding Request per Type

**I hereby certify that all information provided in this application/attachments are true and correct.**

Total Number of Vehicles/Equipment Requested for Funding:	Total Funding Request:
Printed Name of Responsible Party:	Title:
Signature of Responsible Party:	Date:

## **CHECK LIST FOR APPLICATION ITEMS**

**Be sure the following items are included with your application submittal. Check each applicable item below to indicate inclusion of material.**

- ☐ Completed Application (All applicants include Sections A, F and G. New vehicle projects include Sections B and C. Repower and Retrofit projects include Sections D and E.)
- ☐ Checklist for Application Items and Eligibility Criteria
- ☐ Project cost information (as described in the RFP) which shall include vendor quotes or other documentation substantiating cost data provided in Application.
- ☐ Contracting Statements
  - ☐ Signed Statement of Understanding for Work Statement and Deliverables
  - ☐ Conflict of Interest Statement (as described in the RFP)
  - ☐ Third-Party Application Submittal Authorization (Only required if application is submitted by someone other than the vehicle/equipment owner.)
- ☐ Letter of Agreement from Fuel Provider to provide your proposed fleet with alternative fuel (unless you have an existing station).
- ☐ Co-funding information attachments to Section G (if applicable)
- ☐ Certifications and Representations
- ☐ Other (attach explanation)

If you have any questions regarding the application process for Off-Road Heavy-Duty Vehicles, please contact Connie Day, Science & Technology Advancement at (909) 396-3055 by phone, or x3252 by fax.

### **REMINDER**

**Due Date** - The proposer shall submit **six (6) complete copies of the proposal** in a sealed envelope, plainly marked in the upper left-hand corner with the name and address of the proposer and the words "Request for Proposals #2004-04." All proposals are due no later than 5:00 p.m., on Friday, October 10, 2003. Postmarks are not accepted. **Faxed or e-mailed proposals will not be accepted.** Proposals must be directed to:

Procurement Unit  
South Coast Air Quality Management District  
21865 East Copley Drive  
Diamond Bar, CA 91765

## **CONTRACTING STATEMENTS (All Are Required)**

### **1. Statement of Understanding for Work Statement and Deliverables**

In order to minimize the effort required to complete a Moyer Program Application, AQMD does not require submittal of a Work Statement or Deliverables Summary with the Application. However, the undersigned confirms full understanding that, if awarded funding under the Carl Moyer Program, development and submittal of the detailed work statement, with deliverables and schedule, is a requirement of the contracting process. Recommended projects will not receive funding without these documents. Full details of the Work Statement and Deliverables requirements are detailed in RFP #2004-04. In addition, Baseline and Reduced Emission Vehicle Serial/VIN information must be provided at contract start. By signing below, the applicant acknowledges these requirements.

### **2. Conflict of Interest Statement**

Please address any potential conflicts of interest with other clients affected by actions performed by the firm on behalf of the AQMD in the form of a Conflict of Interest Statement. Although the proposer will not be automatically disqualified by reason of work performed for such firms, the AQMD reserves the right to consider the nature and extent of such work in evaluating the proposal. Conflicts of interest will be screened on a case-by-case basis by the AQMD District Counsel's Office. Conflict of interest provisions of the state law, including the Political Reform Act, may apply to work performed pursuant to this contract. Please provide a Conflict of Interest Statement below. If additional room is necessary, please attach extra pages to this sheet.

### **3. Third-Party Application (Circle One:   Applicable   Not Applicable)**

Applicants who are submitting on behalf of a vehicle/equipment owner must provide authorization from the vehicle/equipment owner to act on their behalf for this application process. This authorization shall be provided in the form of a "Letter of Exclusive Authorization", to be attached to this sheet. In addition, the vehicle/equipment owner shall enter into a contract with its authorized applicant, who will sign a contract with AQMD for fulfilling all contract obligations.

Organization:	
Printed Name of Responsible Party:	Title:
Signature of Responsible Party:	Date:

## CHECK LIST FOR ELIGIBILITY CRITERIA

**Please check each applicable box to indicate eligibility of proposed off-road equipment technology.**

- ☐ The off-road equipment is 50 horsepower or greater.
- ☐ The reduced-emission engine/technology:

- ☐ is certified for sale in California, or
- ☐ is under experimental permit for operation in California,

**and**

A. For new equipment purchase projects:

- ☐ is certified to CARB NOx emission credit standard that is at least 30 percent lower than the existing NOx emission standard.

B. For equipment repower projects:

- ☐ is certified to a NOx emission level no higher than 6.9 g/bhp-hr if replacing an uncontrolled engine, or
- ☐ is certified to CARB NOx emission credit standard that is at least 15 percent lower than the NOx emission level of the engine being replaced if replacing an emission-certified-engine.

C. For retrofit kit or add-on equipment projects:

- ☐ shows at least a 15 percent reduction of NOx emissions, and no increase in particulate matter emissions, compared to the applicable standards or emission levels for that engine year and type of application through:
  - ☐ California Air Resources Board (CARB) certification testing,
  - ☐ U.S. EPA certification testing, or
  - ☐ Emission testing at a laboratory approved by the U.S. EPA or the CARB.
- ☐ The retrofit technology is warranted by retrofit manufacturer and/or authorized dealer.

D.

- ☐ The purchase is not required by any local, state, or federal rule or regulation, or used to comply with any such rule or regulation.

E.

- ☐ The purchase is not required by any local, state, or federal MOU or MOA.

F.

- ☐ The amount of emission reduction is not required by any local, state, or federal MOU or MOA.

G.

- ☐ Seventy-five percent (75percent) or more of the equipment fuel consumption or hours of operation will be within the boundaries of the AQMD for at least five (5) years from the date the equipment is placed into service with the new technology.



## NEW OFF-ROAD EQUIPMENT PURCHASE APPLICATION SECTION

For the questions below the following terms are defined: “**Baseline**” refers to the engine or equipment that is being replaced or retrofitted by the proposed project. In the case of a “new project”, the baseline could also relate to information about the diesel or gasoline engine/equipment you would have purchased if this incentive program were not available. “**REV**” refers to the reduced-emission vehicle/equipment being proposed by this application.

### B. INFORMATION ABOUT EACH NEW HEAVY-DUTY EQUIPMENT

1. Primary function of equipment (e.g., construction: earth mover; agriculture: tractor, etc.):	
2. Cost of each new off-road equipment (i.e., Baseline) that meets current emission NOx standard (6.9 g/bhp-hr):	
3. Cost of each new off-road equipment (i.e., REV) that meets CARB NOx emission credit standards ( $\leq 4.5$ g/bhp-hr):	
4. Differential cost of project (per equipment):	
5. Number of engines/equipment to be purchased:	
6. Total Grant Request:	
7. Annual fuel consumption (in diesel gallons) per equipment for Baseline, as defined above:	
8. Annual fuel consumption (in diesel gallons) per equipment for the REV, as defined above:	
9. Percent fuel consumed within AQMD boundaries:	
10. Estimated total annual hours of operation for Baseline:	
11. Estimated total annual hours of operation for REV:	
12. Percent hours of operation within AQMD boundaries:	
13. Is there any seasonality to the use of the vehicle? If Yes, please explain:	
14. Baseline Fuel type:	
15. REV Fuel type:	
16. Baseline Equipment Manufacturer/Model:	
17. REV Equipment Manufacturer /Model:	
18. Baseline Equipment Model year:	

19. REV Equipment Model year:	
20. Baseline Horsepower:	
21. REV Horsepower:	
22. REV Vehicle make:	
23. REV Vehicle model:	
24. Baseline NOx emission level <sup>3</sup> :	
25. Baseline PM emission level <sup>4</sup> :	
26. Certified NOx emission level (g/bhp-hr) for REV <sup>5</sup> :	
27. Certified PM emission level (g/bhp-hr) for REV <sup>6</sup> :	
28. Estimated vehicle life:	
29. Estimated replacement schedule:	
30. Proposed Project Life for Cost-Effectiveness Calculations. See Program Guidelines for more information.	
31. Cost-Effectiveness Calculation Methodology (Note that all projects must use mileage-based method except stop-and-go refuse hauler and street sweeper projects).	<div style="display: flex; justify-content: space-around;"> <span>Fuel</span> <span>Hours</span> <span>Don't Know</span> </div> <div style="text-align: center;">(Circle one)</div>

### C. GENERAL INFORMATION ABOUT THE MANUFACTURER/DEALER

Complete the appropriate information, then skip to Section F, unless you are also applying for Repower or Retrofit projects.

#### NEW HEAVY-DUTY VEHICLE WITH A NEW REDUCED-EMISSION ENGINE

Manufacture/Dealer:	
Street address:	
City:	State:
Phone: (     )	Fax: (     )
Contact name:	

<sup>3</sup> Please refer to Tables for this value.

<sup>4</sup> Please refer to Tables for this value.

<sup>5</sup> This value available from the engine manufacturer.

<sup>6</sup> This value available from the engine manufacturer.

## OFF-ROAD EQUIPMENT REPOWER/RETROFIT APPLICATION SECTION

**Please Circle One: REPOWER RETROFIT**

### **D. INFORMATION ABOUT EACH ENGINE FOR REPOWER OR RETROFIT**

1. Primary function of equipment (e.g., construction: earth mover; agriculture: tractor, etc.):	
2. Cost of replacing or rebuilding engine:	
3. Cost of replacing or rebuilding engine with REV technology:	
4. Differential cost of project (per engine):	
5. Number of engines/equipment to be repowered or retrofitted:	
6. Total Grant Request:	
7. Annual fuel consumption (in diesel gallons) per equipment for Baseline:	
8. Annual fuel consumption (in diesel gallons) per equipment for the REV:	
9. Percent fuel consumed within AQMD boundaries:	
10. Estimated total annual hours of operation for Baseline:	
11. Estimated total annual hours of operation for REV:	
12. Percent hours of operation within AQMD boundaries:	
13. Is there any seasonality to the use of the vehicle? If Yes, please explain:	
14. Baseline Fuel type:	
15. REV Fuel type:	
18. Proposed Project Life for Cost-Effectiveness Calculations.	
19. Cost-Effectiveness Calculation Methodology (Note that you need hour-meters installed on equipment to use hour-based methodology).	<div style="display: flex; justify-content: space-around; align-items: center;"> <span>Fuel</span> <span>Hours</span> <span>Don't Know</span> </div> <div style="text-align: center;">(Circle one)</div>

EXISTING VEHICLE/ENGINE	NEW LOW-EMISSION ENGINE/RETROFIT
20. Equipment Manufacturer/Model:	Equipment Mfr/Model: <i>Same as current</i>
21. Equipment Model Year:	Equipment Model Year: <i>Same as current</i>
22. Baseline Engine make:	REV Engine make:
23. Baseline Engine model number:	REV Engine model number:
24. Serial number of Baseline engine:	Serial number of REV engine:
25. Baseline Horsepower:	REV Horsepower:
26. Average Equipment life:	Estimated remaining Equipment life:
27. Typical rebuild/replacement schedule:	Estimated rebuild/replacement schedule of new REV Equipment:
28. Certified NOx emission level for Baseline <sup>7</sup> :	Certified NOx emission level (g/bhp-hr) for REV <sup>8</sup> :
29. Certified PM emission level for Baseline <sup>9</sup> :	Certified PM emission level (g/bhp-hr) for REV <sup>10</sup> :

<sup>7</sup> Please see Tables for this value.

<sup>8</sup> This value available from engine manufacturer.

<sup>9</sup> Please see Tables for this value.

<sup>10</sup> This value available from engine manufacturer.

## E. GENERAL INFORMATION ABOUT THE INSTALLER

### REDUCED-EMISSION HEAVY-DUTY ENGINE FOR REPOWER (replacement)

Engine installer:	
Street address:	
City:	State:
Phone: (     )	Fax: (     )
Contact name:	

**OR**

### ENGINE RETROFIT TECHNOLOGY

Retrofit Kit manufacturer:	
Retrofit Installer:	
Installer street address:	
City:	State:
Phone: (     )	Fax: (     )
Contact name:	Retrofit kit number:
CARB Executive Order Number:	
Description of retrofit technology:	

## **F. OTHER INFORMATION**

### **1. MAINTENANCE**

Describe your maintenance facility and practices, including any training regarding the low-emission technology. If the training has not been completed, provide a time line for completion.

### **2. REFUELING (for alternative fuels)**

Describe how and where the vehicle will be refueled (e.g. on-site, existing facility, mobile/skid mounted equipment, etc.) Attach written verification of access to refueling facility from the fuel provider if public fueling is not the primary alternative fuel source.

## **G. CO-FUNDING INFORMATION**

Describe your funding sources for this project. At a minimum, this will include your company or agency's own budget for this project. For example, you could show the amount of funding you budgeted for the non-REV portion of the vehicle/equipment.